Mission Settlement 4

- Grade Level: 6-8
- Subject Area: Science
- Duration: Pre-visit: 1 hour
- Setting: Classroom
- Skills: 6,7,8.2B Collect data by observing and measuring 6,7,8.2E Construct graphs to organize, examine and evaluate data
- Charting the Course: Prior to this activity, students should become familiar with general safety procedures for experimentation, exactness in measurement, and graphing
- Essential Terms: water pressure, *acequia*, gravity, depth

ENERGY

Big Idea

Did water pressure affect the amount of energy needed by the mission inhabitants to build the *acequias*?

Objectives

Students will:

- Conduct a prescribed experiment demonstrating water pressure
- Graph the results of the prescribed experiment

Making Connections

The initial survival of any mission was dependent upon the planting and harvesting of crops. Intermittent rainfall and the need for a reliable water source made the design and installation of an *acequia* a high priority. So important was irrigation in Spanish Texas that cropland was designated in *suertes*, the amount of land that could be watered in one day.

Moslems reintroduced the use of *acequias* which were originally brought to the arid regions of the Iberian Peninsula by the Romans. Once arrived on the frontier, Franciscans found the system well-suited for use in the desert Southwest. In areas like New Mexico, it easily blended with the system of irrigation in use for centuries by the Pueblo peoples.

In order to distribute water to the missions along the San Antonio River, the friars oversaw the building of seven gravity-flow ditches, dams, and at least one aqueduct. The missions Indians dug a 15-mile network that irrigated approximately 3,500 acres of mission lands.

The building of this *acequia* system is even more remarkable when one considers that it was built using simple tools, such as picks and shovels, and took countless hours of manual labor. Plumb lines determined how gravity would direct the flow of water through the system, and eventually feed back into the San Antonio River.

Mission Espada's *acequia (*irrigation) system is still in use today. The *acequia madre* (main ditch) carries water to the mission and its neighboring farmlands.

Materials

one per team of 2-3 students

Exploration (pre-visit):

- 20 oz. plastic drinking bottle
- dish
- nail
- water
- scissors

Evaluation (pre-visit):

- graph paper or pre-labeled work sheet

Engagement (Pre-visit):

1. Ask the students if they have ever been to the coast and been "bowled over" by a big wave. Discuss the power of water.

2. Ask if they have ever been at the bottom of a swimming pool and felt a sensation in their ears. Discuss the concept of water pressure.

Exploration (Pre-visit):

1. Each team cuts off the top of the drinking bottle with scissors and makes holes with a nail in a straight line at four different levels (heights).

2. One team member places the bottle in a dish and covers the holes with her fingers.

Another team member fills the bottle with water.

3. When the bottle is full, The team member covering the holes removes her fingers.

4. Describe the action of the water. Longer jets of water shoot out the lower holes. Water pressure is greater at the bottom.

5. Measure the distances from each hole to the farthest point the water reached from the bottle.

Explanation (Pre-visit):

Water can move with enormous power. Sometimes this power comes from the water's momentum, like waves. Sometimes, as with rivers and creeks running downhill, the power is due to gravity.

Power can also come simply from the water's depth. Just as with the atmosphere, pressure in water (its power to push) increases with depth. The deeper the *acequias* were dug, the deeper the water's depth, giving the water more pressure and increasing water flow.

Evaluation (Pre-visit):

Have each student graph the distances from each hole to the farthest point the water reached from the bottle. A graph work sheet is provided - S4A.

Elaboration:

A more extensive look at *acequias* can be found in the unit called Water Distribution.

Notes:

GRAPH WORK SHEET